*A. George Mallis*
*Lieutenant Colonel (AUS-Ret)*
*788 Stony Hill Road*
*Wilbraham, Massachusetts, 01095*

Oct. 27, 1995 IDENT: NEWMAN52

Mr. Eric P. Newman
Eric P. Newman Numismatic Education Society
6450 Cecil Avenue
St. Louis, Mo.,63105

Re: Early American Imprints: 40669
Scale Invention of Benjamin Dearborn; 1817

Dear Eric;

As I told you over the telephone this past week, our local library was able to obtain the microfiche film from the University of Delaware Library and I had a hard copy made for our files.

Enclosed are the following:

1. 8½ x 14 photocopy of the microfiche copy.
2. 8½ x 11 photocopy of the microfiche copy using two standard pages.
3. Typed copy of the microfiche copy for use in our book as you see fit. I tried to check the typed copy against the original microfiche copy but I could have missed something in the copying. If you should find any such error please let me know in order to correct the typed copy. Incidentally, there are some hand written words interlined in the original text that I have not been able to interpret. May be you can read the writing.

By this time you should have received your copy of the auction catalogue for the up coming sale by Bowers and Merena in New York. I received mine last week and was delighted with it.

The local library is still trying to get the three volumes of the invention patents from 1790-1870. When they do get it, I will go through these books and a make a note of any coin scales or counterfeit coin detectors therein. I will let you know the results of my efforts when I can see the books.

As ever;

encl: noted

S40669; Early American Imprints

Directions for Using the Gold Standard
Balance, Invented by Benjamin Dearborn,
Boston, 1817. Broadside.
MHi copy.

Microfiche furnished courtesy of The University Of Delaware, Newark, Delaware through the Wilbraham Public Library.

COVER SHEET

# DIRECTIONS FOR USING

## *The Gold Standard Balance,*

Invented by BENJAMIN DEARBORN, of Boston, Massachusetts

The beam is mounted on a platform having a screw at each corner, for the purpose of fixing it perfectly level and steady; and care should be taken that it be always so placed, which can be readily ascertained by applying a plumb-line to the columns, because they will be perpendicular when the platform is level.

On the platform a lever is placed, whereby the beam, scales and weights are raised for any operation in weighing, and let down as soon as the operation is completed. It is best to bring the beam to a state of rest, as often as any change is necessary in the weights, or the article to be weighed; it should always be kept in a state of rest at all times when not in~~n~~ actual use. When a beam is constructed to rest on screws, they should not be moved after being fixed at their proper height, which is thus known. If the screws be too high the beam will roll thereon, producing a lateral motion of the index between the parallels; if the screws be too low, the beam will not come down to rest on both at the same time; if one is too high and the other too low, the index will rest out of the center, inclining toward the highest screw; when none of these effects are produced, the screws are at the proper height.

The index is fixed with a brace to the lower edge of the beam, pointing down to a center, which shews when the beam is level. A small weight is fixed upon the index in such a manner as to be moved higher or lower, and remain stationary wherever it is place; this weight is termed a MOTOR, the proper place for which is easily ascertained thus; when the scales are adjusted to exactly equal weight, while the beam remains up, put each scale alternately down to the table, and observe if they rise, letting the beam vibrate; if they do not, the motor is too high, and must be brought lower; if they rise with a quick motion, the motor is too low, and must be moved higher, until the scales will just rise from the table with a slow motion; this will be the proper place for the motor in weighing all small drafts, and with any draft the beam will turn with great ease, without raising the motor, consequently it very rarely requires to be moved. But, if the scales are heavily loaded and *extreme precision is required* in the weight, the motor may be raised as high as it will bear, by the foregoing rule: that is to say, after the scales are loaded with equal weights, raise the motor so high that the scales with their load shall just rise from the table, the beam vibrating with a slow motion. Whenever the motor is moved the beam should be in a state of rest. Beams of this construction are thus made to turn with nearly the same ease when heavily as when lightly loaded.

To preserve the exact balance of the beam, an instrument called an Equipoise is fixed on the top of it, turning on an axis, and moved by two screws, which throw the weight of the equipoise toward the right or left, for counteracting such little inequality in the weight of the scales as may be produced in time, by a difference in wearing, or by more dust adhering to one or the other. If the beam from these causes, should at any time lose its perfect equilibrium, it must be restored by slaking the screw of the equipoise on the side of the lighter scale, and turning up the other. This should be done while the beam is at rest, and the screws must be turned tight, to preserve the position of the equipoise when set.

The ends of the beam terminate in sharp edges turned upward, by which construction it is very easily corrected if the edges should wear dull in time, or if one arm should proved longer than the other, which is ascertained by changing equal weights in the scales after they have been very accurately balanced by the equipoise. If one arm be longer than the other, an oil-stone must be applied to the outer side of the edge on the longer arm, and a little rubbing will shorten the former, or lengthen the later; but care must be taken not to do too much, for when the arms are very nearly equal in length, the longer may be made the shorter by rubbing for a few seconds, although the edges are hardened steel.

On the ends of the beam, two Pendants are suspended having polished steel caps, which rest on the sharp edges above described. To these pendants the scales are attached by screws, whereby the length of each can be so increased or diminished, as that the index shall be central when the scales rise from the table.

The pendants are marked R. and L. to represent right and left, with these letter facing the operator. As the beam is originally adjusted with the pendants in those positions, it will be expedient to avoid changing them in use, although no perceptible difference may be produced by the change.

Whenever the beam is to be raised or let down, the operator should be particularly cautious to prevent the lever from slipping out of his hand, for a single inattention in this particular, may destroy the accuracy of the instrument; and it is so extremely susceptible that the lightest current of air will give it motion; consequently a case should encompass it on all sides. This case is generally glazed on the .............

Four different denominations of this Balance have been introduced, namely the first or higher style, for weighing gold to the amount of five thousand dollars at a draft. The second style of similar power. The first style for fifteen hundred dollars at a draft, and the second style of similar power; and one of which will weigh a single piece with requisite precision.

Weights for gold are also furnished at the same factory, adjusted to pennyweight and grains, or to dollars and cents of the different gold coins, as estimated by the laws of the United States.

The Gold Standard Balance has now survived the scrutiny of fifteen years, in which time it has been adopted by all the Banks in Boston, and many others in the United States; the Inventor therefore feels himself justified in recommending it to all Banking Institutions wherein superior accuracy is an object of ambition.

BENJAMIN DEARBORN
Balance-Factory

*Boston, Nov. 1817*

Illegible written signature of witness.

# DIRECTIONS FOR USING

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Invented by **BENJAMIN DEARBORN**, of BOSTON, *Massachusetts.*

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On the platform a lever is placed, whereby the beam, scales and weights are raised for any operation in weighing, and let down as soon as the operation is completed. It is best to bring the beam to a state of rest, as often as any change is necessary in the weights, or the article to be weighed; it should also be kept in a state of rest at all times when not in actual use. When a beam is constructed to rest on screws, they should not be moved after being fixed at their proper height, which is thus known. If the screws be too high the beam will roll thereon, producing a lateral motion of the index between the parallels; if the screws be too low, the beam will not come down to rest on both at the same time; if one be too high and the other too low, the index will rest out of the centre, inclining toward the highest screw; when none of these effects are produced, the screws are at the proper height.

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To preserve the exact balance of the beam, an instrument called an Equipoise is fixed on the top of it, turning on an axis, and moved by two screws, which throw the weight of the equipoise toward the right or left, for counteracting such little inequality in the weight of the scales as may be produced in time, by a difference in wearing, or by more dust adhering to one than the other. If the beam from these causes, should at any time lose its perfect equilibrium, it must be restored by slacking the screw of the equipoise on the side of the lighter scale, and turning up the other. This should be done while the beam is at rest, and the screws must be turned tight, to preserve the position of the equipoise when set.

The ends of the beam terminate in sharp edges turning upward, by which construction it is very easily corrected if the edges should wear dull in time, or if one arm should prove longer than the other, which is ascertained by changing equal weights in the scales after they have been very accurately balanced by the equipoise. If one arm be longer than the other, an oil-stone must be applied to the outer side of the edge on the longer arm, or to the inner side of the edge on the shorter arm, and a little rubbing will shorten the former, or lengthen the latter; but care must be taken not to do too much, for when the arms are very nearly equal in length, the longer may be made the shorter by rubbing a few seconds, although the edges are hardened steel.

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Weights for gold are also furnished at the same factory, adjusted to pennyweights and grains, or to dollars and cents of the different gold coins, as estimated by the laws of the United States.

The Gold Standard Balance has now survived the scrutiny of fifteen years, in which time it has been adopted by all the Banks in Boston, and many others in the United States; the Inventor therefore feels himself justified in recommending it to all Banking Institutions wherein superior accuracy is an object of ambition.

BENJAMIN DEARBORN.
Balance-Factory.

*Boston. Nov. 1817.*

[illegible]

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BENJAMIN DEARBORN.
Balance-Factory.

*Boston. Nov. 1817.*

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No. 4.

# THE PATENT BALANCE

COMPARED WITH

# Other Instruments

# FOR WEIGHING.

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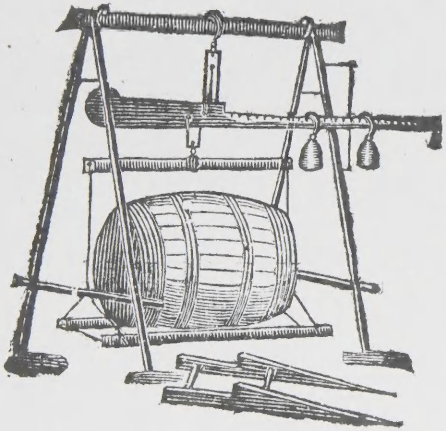
PHILADELPHIA:
Printed by Robert Cochran, 108, Race-street.
1803.



Am 803
C 602

# (CIRCULAR.)

To the PRESIDENTS and MEMBERS of the SELECT and COMMON COUNCILS of the City of Philadelphia.

*Philadelphia, February* 24, 1803.

GENTLEMEN,

AS some Members of the Councils were absent on the 9th of December last, when my Memorial was read before your respective Boards, I present a printed copy of it, that all may know its tenor; and, as Objections have been urged against permitting the use of that correct instrument, the PATENT BALANCE, in the market, I also present a copy of my replies to those objections, that all may have an opportunity of leisurely weighing one against the other in the balance of reason and candour.

*The Memorial was as follows.*

To the SELECT and COMMON COUNCILS of the City of Philadelphia.

GENTLEMEN,

IN the year 1799, I presented a Memorial to the Common Council of this city, respecting my Patent Balance; *only asking* that it might be permitted to be used in the market. A committee was chosen, who after a very critical examination of the principles and the operation of the Balance, and after subjecting it to experiments made by several ingenious artists, presented a report of such tenor, as valuable improvements always merit. This Report, which is transcribed in your records, under the date of March 19th, 1799, closes with recommending the adoption of the following resolution, viz.

" Resolved, That the use of Benjamin Dearborn's Vibrating
" Steelyard be permitted in the markets of this city; and that
" a committee be appointed to bring in a bill authorising the
" same."

Being obliged to leave the city, I had not an opportunity of explaining the principles of my Balance to the Councils, but have been since informed, that the bill passed in one, and was rejected in the other. I presume that the only ground on which my unaspiring request could have been refused, was some mistake concerning the mathematical principles of the Balance, and suppose that this mistake existed in an erroneous opinion that its principles were similar to those on which the common Steelyard is constructed: It therefore becomes necessary to explain and compare principles, for which purpose this is accompanied with drawings and mathematical demonstrations.

Since the report above mentioned, a law, authorising the use of my Balance, has been passed by the Legislature of Massachusetts, whose committee were so extremely particular, in ascertaining its accuracy, that I was directed by them to make application to the Professor of Mathematics at Harvard college for obtaining a certificate of the statical correctness of its principles; and, if a single error had been discovered, either radical or accidental, no argument could have obtained one vote in its favour: a copy of this act, and of Professor WEBBER's certificate, are in the hand-bill herewith presented. If the multiplied testimonies in this bill, and numerous others which I possess in manuscript, be not sufficient evidence, the Balance can again be subjected to any required experiments. By such experiments it has been proved, in this and almost every other state of the Union from New-Hampshire to Georgia, and its accuracy and convenience are thereby established, on a basis, lasting as the principles on which it is predicated.

The Patent Balance is now preferred in many of the states to any other mode of weighing:—it is adopted in the market at Washington, the capital of the United States, and by the American government for weighing cannon, and all doubts respecting it are now removed, except this—Whether it is expedient to prohibit the public use of an accurate, convenient, and valuable Instrument, merely because it looks somewhat like another instrument, which by fixed errors in principle is made applicable to fraudulent purposes.

The design of this Memorial is to solicit that the respectable bodies to whom it is addressed, will take the subject into consideration, and pass to such decision, as in their wisdom they shall think meet, for granting or refusing the use of the Patent Balance in the markets of this city.

Respectfully submitted by,
Gentlemen,
Your most obedient,
and very humble servant,

BENJAMIN DEARBORN.

*Philadelphia, December* 9th, 1802.

On reading the foregoing Memorial, it will be observed, that the only request it contains, is, that the Councils will take the subject into consideration, and pass to such decision, as in their wisdom they shall think meet, for *granting* or *refusing* the use of the instrument in the market.

The Councils have wisely prohibited the use of common Steelyards in the market, on account of the fraudulent purposes to which they may be applied; this prohibition *virtually* operates against the introduction of my Balance, although it was not known in the city at the time the prohibition took place; but, whether in *legal* construction it would extend to the exclusion of a correct instrument, which was not known by the Councils at the time of passing the Ordinance, is a subject which I shall not attempt to discuss. I ask no patronage for the Instrument, except this, that society be at liberty to use it or not, at their pleasure. To decide whether the community shall have this liberty I had anticipated but one point on which the question could turn, which is *correctness*. This particular having been fully ascertained, to complete demonstration, I saw no rational objection which could be offered against its introduction.

Facts and Mathematical Demonstrations are the only arguments which I have used throughout the progress of the business. Opinion I have never offered as testimony, nor theory for experiment; yet opinions and theories are brought against facts and demonstrations, and are urged as objections against allowing the people the liberty of choosing whether they will make use of my Balance or not.

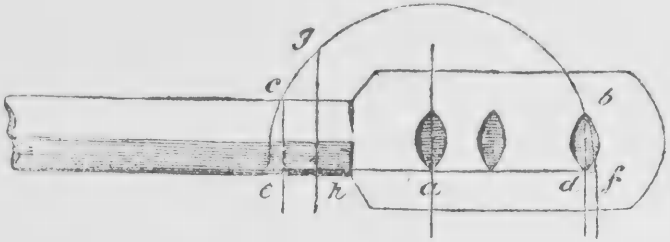
These Objections I shall state, as far as I comprehend them, and whether they be applicable to the original question, or foreign to it, I shall offer mathematical demonstrations and facts in reply. Hence every member of the Councils will have an opportunity of viewing *both sides* of the subject, and of making his decision upon a knowledge of its merits.

## ONE OBJECTION.

### *That the Patent Balance is not equal to the Common Steelyard.*

In reply to this objection, I shall describe some of the governing characteristics of both, and present a mathematical demonstration of their difference in principle.

## The Common Steelyard.

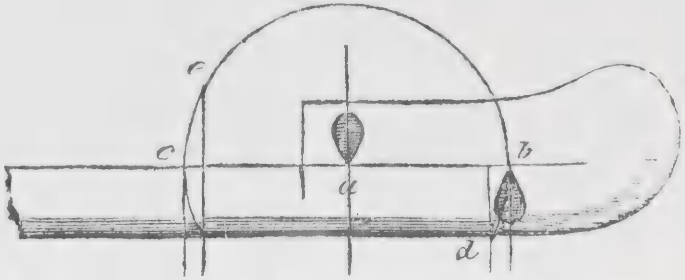


*The Principles of the Common Steelyard explained.*

The ends of the three pivots appear in the centre of the breath of the beam: *a* is the centre of motion, upon which the beam turns in the arch of a circle: *b* is the point where the article to be weighed is suspended, and *c* is the point where the poize is suspended, both being *above* the centre of motion. While the beam remains level, the horizontal distances of these points of suspension from the centre of motion, are *a d*, and *a c*. Depress the larger end of the beam until the point *b* falls to *f*, and the point *c* will rise to *g*. It is evident, that on the falling side the horizontal distance *a d* is increased to *a f*; and that on the rising side, the horizontal distance *a e* is reduced to *a h*. Thus by an increasing power on the falling side, the reducing power on the rising side is overcome, and the equilibrium is destroyed. Hence the reason why the Common Steelyard, and every beam constructed on those principles, must ever be liable to error and to fraud.

With the radical error above exemplified, two other errors are united in the Common Steelyard; all of which are carefully avoided in the construction of my Balance.

## The Patent Balance.



*The Principles of the Patent Balance explained.*

The ends of two pivots appear near the shoulder in the beam. *a* is the centre of motion, upon which the beam turns in the arch of a circle: *b* is the point where the article to be weighed is suspended, and *c* is the point where the poize is suspended, both being *on a line* with the centre of motion. While the beam remains level, the horizontal distances of these points of suspension from the centre of motion, are *a b*, and *a c*. Depress the larger end of the beam, until the point *b* falls to *d*, and the point *c* will rise to *e*. It is evident that the horizontal distances are both reduced, and that this reduction of distances is always equal or proportional, on both sides of the centre of motion. Thus the beam preserves its vibrations like a scale-beam, and hence the reason why NO ART in management, can render it a fraudulent instrument.

## ANOTHER OBJECTION.

### *That the Patent Balance does not turn so easily as a Scale-Beam.*

In reply to this objection, I offer the following remarks. Every person who is acquainted with statical principles, knows that the ease with which a beam turns, depends on the sharpness of the edges which form the points of suspension and centre of motion, and the position of the latter, as it respects those points and the centre of gravity. If the centre of motion be placed too high, the beam does not turn with ease; if too low, it turns, like the Common Steelyard, either way, as the weigher chooses. Between these extremes, there is a certain point where the centre of motion ought to be placed; and this point is found as easily in my Balance as any other.

The Patent Balance turns so easily, as always to detect incorrect weights, if they are put upon it; this was abundantly proved in presence of the Committee, by trying weights, first with the Balance, then with the brass legal standard weights of the City, and both experiments gave precisely the same demonstration of the errors of the weights, which were before supposed to be correct. The Balance which I used on the above occasion, has been made more than twenty years; through this period it has been much used, and very carelessly handled, and has not been repaired; yet it required not one-third part of one per cent to turn it. I am doubtful whether a Scale-beam, of a size for weighing three hundred pounds, and which had been in use twenty years, would turn more easily; but any individual who has such a beam can ascertain this point, to his own satisfaction. The weight used in this experiment was fifty six pounds.

In the certificate of James Simons, Esq. Collector of the Customs in Charleston, South Carolina, the following passage makes a part of the report of the Surveyor and Weigh-Master, who were extremely particular in making their experiments.

> " In weighing a hogshead of sugar in the scales, it required
> " three pounds weight to preponderate the scale. In weighing
> " the same hogshead of sugar in the Patent Balance, half a pound
> " weight would preponderate the scale."

Respectable characters in Philadelphia, have given certificates of the accuracy and convenience which attend the use of the Patent Balance, and of the ease with which it turns and vibrates, even after being roughly used for a length of time. Gentlemen of the first standing in society, in the northern, southern, and middle states, have given like testimony. Facts speak the superior value of this system for weighing in every comparative experiment which is made; and every purchaser, who desires to satisfy himself respecting those facts, is always indulged with making any experiments he requires, previous to purchasing.

The Patent Balance has been purchased by the Government for weighing cannon, by the President of the United States, the Secretary of the Treasury, and the Secretary at War, for use in their respective families; it is adopted in the market at Washington, and one of them is ordered for the hay-market in the same city: it is introduced into many of the Custom-Houses, and in some of them it is the only instrument which is used for weighing; and in the Commonwealth of Massachusetts, it is patronized by an act of the Legislature.

## ANOTHER OBJECTION.

### *That the Patent Balance is described in the Encyclopædia, consequently is not new.*

To this I shall reply in sections.

§. 1st. Whether the Balance be new or old, appears to me to be a question which is totally foreign to the subject of discussion, which is, if the use of it *shall* be permitted, or *shall not* be permitted in the market.

§. 2d. If the Patent Balance had been an invention before known and used, government would not have granted a Patent for it.

§. 3d. The publication on which this assertion is founded, as I am informed, is the 17th volume of the Encyclopædia, published by Mr. Dobson in May 1797, from an Edinburgh edition, which (according to the best information) was published some time in the year 1796. I possess the testimony of a gentleman now in this city, that I shewed my Balance to him, in the year 1783. This was *fourteen years* before the publication of that volume, which is now brought forward in opposition to the Patent Balance, a description of which, was communicated to the American Academy of Arts and Sciences, long before that publication was in existence.

§. 4th. The Encyclopædia contains no description (within my knowledge) of any instrument like my Balance; nor would all the properties of all the Balances described in the Encyclopædia, furnish means for making only a beam and weights similar to mine; independent of the other appendages which I have formed, to complete the conveniency of the system. This I shall demonstrate, by comparing my Balance with those in the Encyclopædia, with which it has been compared by others, as similar.

In the 17th volume, opposite to page 784, is plate 481;—figure 1 in this plate represents a beam which possesses one principle, and one only, in which we exactly agree, in correcting the errors of the Common Steelyard; this is placing the points of suspension, and the centre of motion in a right line.

One principle makes not a system.

Another principle, is what in the Encyclopædia is termed the *Range* of the instrument, that is its extent, from the lightest to the heaviest bodies it will weigh. In figure 1, this principle is reduced so far, even below the Common Steelyard, that the instrument could be of very little use; hence the reason why we see it only on *paper*. On the other hand, the extent or range of my Balance, is carried beyond any other which is known. These contrasting qualities I shall exemplify.

In the description of figure 1, the word counterpoise is invariably in the singular number—even where the term double counterpoise is used, it is singular, which proves that the author's meaning was a counterpoise of double the weight. On viewing figure 1, we find it drawn with but one counterpoise. In page 779, col. 1st, near the bottom, is the following remark, "it is usual to make as many divided scales on the long arm as there are points of suspension on the short arm." From the beginning to the end of the description, not a word appears which indicates that the writer ever conceived an idea of applying two counterpoises of different weights on one beam, or of having two graduated scales on the beam, unless there were two points of suspension on the short arm. Hence it is evident, that but one counterpoise was ever designed or contemplated for this instrument. It is as evident, that if this counterpoise should be heavy, it could not weigh light articles, and if it was light, it could not weigh heavy articles. If further testimony is necessary on this point, we find it in page 779, column 1st, near the bottom, in the following words; "But the *range* of this instrument is not altogether at the pleasure of the maker." On the contrary, the range of *my* Balance *is* at the pleasure of the maker; the range of that which was made for the GOVERNMENT for weighing cannon, is from one pound to seven thousand and five hundred pounds, and its principles are applicable to *any* range, from one pound to the greatest extent which a beam of any kind can support. Beside the advantage of range, my Balance is possessed of another, of a singular nature, and important in application; this is an inherent proof of the accuracy of the principles on which it is predicated, and of the workmanship with which it is executed. This proof is produced by the variations which may be made in weighing one and the same article, by placing the poizes in different situations on the beam, whereby as many changes may be made, as the article contains pounds in weight; this singular principle, is unknown in any other system for weighing. These essential advantages of my Balance over that described in figure 1, arise from my manner of applying on one and the same beam, weights which are multiples, and having two divided scales on the long arm, with but one point of suspension on the short arm; using a lighter weight for smaller articles, and a heavier weight for others, or both together, or any number which may be necessary, without extending any weight beyond 32lb. which is the heaviest I use; and is very easily handled. If heavier weights should be preferred by any person, they might be made of 64lb. or 128lb. but none larger than 32lb. are either necessary or convenient.

I shall exemplify these remarks, by drawing a comparison between the characteristics of a Patent Balance which is now in use in Philadelphia, for weighing three thousand pounds, and the unavoidable inconveniencies which must have attended the same Balance, if it had been made according to the description of figure 1, plate 481, in the 17th volume of the Encyclopædia.

1st. The counterpoizes belonging to the Balance above-mentioned, are three of 32lbs. each, and one of 16lb. making in the whole 112lb.—these are all used for weighing 3000lb.——consequently, if the Balance had been made on the principles of figure 1, it must have been accompanied with a counterpoise of 112lb. weight, equal to all those.

2d. The counterpoise to be lifted from notch to notch on the Balance, for finding the exact weight of the goods, weighs only 16lb. If the construction had been on the principles of figure 1, the counterpoise to be lifted from notch to notch, must have weighed 112lb.

3d. The smallest quantity which can be weighed with the above mentioned Balance is *one pound*. If it had been made on the principles of figure 1, the smallest quantity it could have weighed would be *seventy pounds*, except other weights were used beside the counterpoise.

4th. The number of notches on the Balance, corresponding to one pound each, are something short of *seven and a half* to an inch. If it had been made on the principles of figure 1, the number of notches, corresponding to one pound each, must have been *fifty-one* to an inch.

As these proportions are founded on mathematical and statical principles, they are easily demonstrated.

§. 5. The place of the centre of gravity is another principle; here again we disagree. In fig. 1, it is placed somewhere in the long arm, depending on the scale to bring the beam to a horizontal position, as is explained at the bottom of column 1st, page 778; nothing therefore can be weighed with that beam, unless the scale is on it, or the weight of the scale added to the weight indicated on the beam, or accounted for in some other way.

My Balance has the centre of gravity exactly under the centre of motion, and preserves its horizontal position independently of the scale; from this construction arises the advantage of weighing either in the scale, or by the hook without the scale; and the figures on the beam shew the exact weight of the article in both cases, without any calculation for the weight of the scale, which is balanced by a small weight at the end of the long arm, a hole being made at the extremity of every beam, for that purpose.

My Balance, from this accurate and convenient arrangement, becomes peculiarly useful in markets and in families; for with a beam of a size for weighing two or three hundred pounds, which has a tin or other scale attached to it, the lighter and loose articles are weighed with ease and precision; while the same beam is calculated for weighing articles by the hook, which are too large for the scale, such as quarters of beef, &c.

§. 6. In the volume before mentioned, page 779, col. 2d, we find two remarks upon the *sensibility* of beams on this principle; the first is scientific, and the other experimental; as I cannot reconcile them, I quote them both. The first is in the following words

“ A scientific examination of the Steelyard will convince us that “ it is inferior to the Balance of equal arms in point of sensibility.” Four lines further in the same paragraph, is the following: “ We “ have seen one at Leipzig which has been in use since the year “ 1718, which is very sensible to a difference of one pound, when “ loaded with nearly three tons on the short arm.” Here, as is frequently the case, the testimony of experiment contradicts that of theory; and as the author has left the reader to take his choice, I prefer the testimony of *experiment*, which produces another proof that beams with a long and short arm may be made to turn with a wonderful degree of ease, notwithstanding any arguments of *theory* to the contrary.

Between the passages above quoted, the author makes the following remarks upon the steelyard; “ But it is extremely com- “ pendious and convenient; and when accurately made and at- “ tentively used, it is abundantly exact for most commercial pur- “ poses.” By this it appears that the writer when speaking of the sensibility of the steelyard, had reference only to the weighing of gold, or some very precious commodity; and that for most commercial purposes he thinks it abundantly exact.

§. 7. The next object for comparison is the Leipzig Balance just mentioned, which is handsomely delineated in fig. 4 on the same plate as the other. A few remarks upon this, may suffice, as the first sight of the figure shews us that the beam is constructed like the Common Steelyard, with two points of suspension on the short arm, both of which are above the centre of motion, and the point where the poize is suspended is still higher; but the beam is not turned over, or reversed, like the common steelyard.

The description of this instrument commences near the bottom of column 2d page 779, and extends nearly to the close of the next page, wherein we find the following information.

That no article can be weighed with it, which is short of 300lbs.

That the counterpoise weighs about 125lb.

That with the counterpoise alone, the beam will weigh from 300 to 1200lb.

That beyond 1200lb. it is necessary to lift on an eke weight, by means of a little tackle, which continues the scale to 2000.

That beyond 2000lb. the load must be hung on the inner pin.

That the eke weight must then be taken off and another put on.

That the scale is then extended to 4000lb.

That beyond 4000lb. it is necessary to lift the former eke weight on again.

That the scale is then extended to 5800lb. and goes no farther.

That the load is raised from the ground by a great oaken lever 22 feet long.

That this very ponderous machine with its massy weights cannot be easily managed, without some assistance from mechanics.

On reading the foregoing particulars, it will be observed, that if a load is taken up on the outer pin, and is found to exceed 2000lb. it must be let down and disengaged; that this “ponderous machine” must be drawn in, and the “stirrup” with its chains, &c. must be lifted off from the outer pin by a tackle, and hung on the inner pin; the “ ponderous machine” must then be run out again; and again the load must be taken up by the “ great oaken lever;” one eke weight must be lifted off, and another on, by a tackle; and then the load is ready for being weighed.

The foregoing circumstances form such a contrast with the simplicity, portableness, and conveniency, of my apparatus, and with the ease with which my beam is used; where neither oaken levers, tackles, ponderous machines, nor massy weights are wanted; and where no change of the load is necessary whether it be light or heavy,—that even a *comparison* pays a compliment to the Patent Balance.

Much ingenuity is certainly discovered in the construction of the machinery attending the Leipzig Balance; but, unluckily this ingenuity is expended on encreasing the labor and expense beyond what is necessary, and in rendering the instrument inapplicable to domestic purposes, and useless for small weights.

Had the author seen the simple mode of weighing loaded carriages in New-England, I suspect he would have saved his engraver's fee, and the trouble of writing his description, except that part describing the sensibility of the beam, in which I should suppose it must exceed any scale-beam.

In the volume before mentioned, is the following passage, page 778, column 1st, under the word *Steelyard.*

“ It was the *statera* of the Greeks and Romans, and seems to “ have been more confided in by them than the Balance; for “ which reason it was used by the goldsmiths, while the Balance “ was the instrument of the people.”

Some remarks on the advantages which give my system of weighing a superiority over Scales and Weights, will close the present description. To render them concise and intelligible, they are presented in the form of distinct Positions, demonstrated by facts.

## POSITION 1st. *My system is not liable to the Errors to which Scales and Iron Weights are subjected.*

### Demonstration by Facts.

Iron weights are liable to continual variation by rusting.

My brass cased weights are not liable to that variation.

Iron weights, from their brittle nature, are subjected to having pieces broken off, which, from the roughness of their construction, might not be noticed.

My weights are not of a brittle substance, and by being neatly turned in a lathe, if an accident befalls them, it is immediately discovered.

Iron weights are subjected to the loss of the lead, by which they are adjusted, and of that which is added, to correct the injuries of time.

My weights, having no lead on the outside, can suffer no such loss.

Iron acquires a magnetic attraction, and that attraction may act reciprocally between weights in the scale and others on the ground.

My weights can acquire no such attraction.

The swan-neck ends of a small scale-beam may in one minute be so altered with a hammer, as to make one scale give more, and the other less than just weight.

My beam admits of no such alteration.

## POSITION 2D. *My Balance with its apparatus is less expensive in the first cost, in repairs, in transporting, and in using, than Scales and Weights.*

### Demonstration by Facts.

A scale, beam, weights, &c. purchased not long since, for weighing hogsheads, cost the following prices:

| | |
|---|---|
| The beam, - - - - | *Dolls.* 46 66 |
| Adjusted weights, for 112lb. *dolls* 4 34 the amount of 20cwt. would be - | 86 80 |
| Chains and irons for the scale bottoms, - - | 23 77 |
| The cost of the scale bottoms and triangles are unknown, and are therefore omitted. | |
| | *Dolls.* 157 23 |

The Patent Balance for weighing 20 cwt. costs as follows at the Manufactory in Boston:

| | |
|---|---|
| The beam *doll.* 40. The weights with grosses, 17 50 | *D.* 57 50 |
| The scale skid and balance weight, - - - | 13 75 |
| Box to contain the weights, - - | 41 |
| Cost of the Patent Balance, | *dolls.* 71 66 |
| Saving in favour of the Balance, | 85 57 |
| | 157 23 |

The frame and the screw are omitted in this estimate, because the triangle could not be given in the other; if both were inserted, the difference would be still greater.

Scales for weighing a ton, are accompanied with forty iron weights; the corrosive quality of those weights produces a necessity for frequent repairs, and their great number makes those repairs expensive.

A Patent Balance for weighing a ton, is accompanied with three brass cased weights; the quality of the metal is such, that they can very seldom want repairs, and the number of weights is so small, that the expense of those repairs must be trifling.

One or two teams are necessary for transporting scales, weights, and their apparatus for weighing a ton.

One man with a hand-cart, can transport the Balance with all its weights and apparatus for weighing a ton.

The expense of transporting articles to scales to be weighed, is considerable, and if the weights are to be lifted off and on for each draught, the labor is immense.

The Balance is set up either in the store or out of it, is moved with facility without being taken down, and two hands only are necessary for weighing hogsheads; which are taken up and weighed with ease and expedition, over the spot where they lie.

## POSITION 3D. *The Patent Balance is calculated to give Neat Hundreds or Gross Hundreds, as the article to be weighed may require, without reducing one into the other.*

### Demonstration by Facts.

Small weights accompany the poizes, which add exactly 12 per cent thereto; these are called grosses. The poize alone gives neat hundreds; but, with its gross, every hundred is a gross hundred, or 112lb. and every pound is a gross pound, or the 100th part of 112lb. From this construction arise the following advantages.

1st Neat or gross weight is given, without reducing one into the other.

2d When quantities in gross weight are to be added together, the operation is performed by simple addition, instead of compound.

3d The value of articles in gross weight, is calculated by simple multiplication instead of compound, provided the price be named in dollars and cents.

4th By thus dividing the gross hundred decimally, the price of every pound is just as many cents, as the hundred is dollars, producing an exact correspondence with our currency.

## POSITION 4TH. *Some Correct Instrument, more convenient than Scales and Weights, is much wanted in the Market.*

### Demonstration by Fact.

A considerable proportion of the small meat sold in the market, is taken by the purchaser without seeing it weighed, because but few come accommodated with scales and weights, compared with the whole number of persons who supply the market. If the Patent Balance were introduced, its conveniency would recommend it to many who find scales and weights too troublesome to transport a considerable distance.

A Balance for weighing 100 or 120 pounds may be calculated for its small poize to weigh one pound, or two pounds, or four pounds, the larger poize in either case, being 8 pounds. If the small poize be one pound, the beam with that alone will weigh a-any article not exceeding 10 or 11 pounds, each notch or division on the beam corresponding to one ounce. If the small poize be two pounds, the beam with that alone will weigh any article not exceeding 20 to 24 pounds, each notch corresponding to 2 ounces. If the small poize be four pounds, the beam with that alone will weigh any article not exceeding 34 to 40 pounds, each notch corresponding to four ounces, or a quarter of a pound.

By this it will be observed, that each division on the beam corresponds to as many ounces, as the poize weighs pounds, and that the poizes make excellent weights for scales also.

To the foregoing positions, I hope to be enabled to add the following—That the Councils of the City will not permit it to be said, that Philadelphia furnishes the only municipal body, who would check the progress of the useful arts in America. Whether this hope is to be realized or not, I respectfully solicit, that at the next meeting a final decision may take place, as it is now nearly three months since my Memorial was presented.

I have the honour to be,
with due respect,
Gentlemen, your humble servant,

BENJAMIN DEARBORN.

Mr. Dearborn presents information that he will attend at four o'clock on Saturday afternoon the 26th instant, at Mess'rs Shoemaker & Berrett's office, No. 9 south front street, for the purpose of exhibiting the Patent Balance to those Gentlemen of the Councils, who may wish to examine its operations but have not yet had an opportunity. If that period be inconvenient to any Member, he shall be waited on at any other time he may appoint by a line, left at No. 56 Walnut street.

If it should rain on Saturday afternoon, the same hour on Monday, or the next fair day, will be appropriated to the purpose.

Philadelphia, Feb. 24, 1803.

Am 99
3327

# DEARBORN'S System for weighing with EASE, DISPATCH, and PRECISION; Purchased for Half the Cost, and used with Half the Labor, of Scales and Weights.

UBSCRIBER, Patentee of the PROPORTIONAL BALANCE (which has been usually : Patent Balance) informs the Public, that he has now the Sole direction of manufacturing ing that valuable instrument; and adds his assurances, that no efforts shall be withheld for g the reputation which it has already gained.

; the time this Balance has been known to the public, the three following questions have y been put to the Proprietor.

not your Balance liable to be often out of repair ?

what consists the difference between this and the common Steelyard ?

ill not the effects of heat and cold tend to destroy the accuracy of the Instrument, by ex- and contracting the Beam ?

llowing Facts, Demonstrations and experiment, are replies to those questions.

## Facts in reply to question 1st.

lance which was originally made for experiment, was for domestic use, and is calculated ing 234 lb. The Subscriber has the written testimony of a Gentleman of undoubted vera- he shewed him the Instrument in the year 1783.

he time of its being finished it has been much and roughly used, notwithstanding which, it as yet, not the smallest indication of the want of any repair.

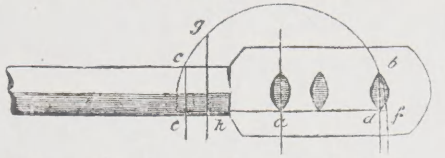
st Beam for weighing large draughts was made since the Patent was obtained ; it has been rly four years, and has been exercised in weighing at least sixteen thousand hogsheads.

ot yet required even a second painting or any other repair, and performs exactly as at out exhibiting the least testimony of defect.

er proofs of its durability be sought, time only can furnish them.

## Demonstrations in reply to question 2d.

The
mmon
elyard.



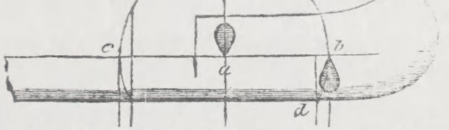
### he Principles of the Common Steelyard explained.

ds of the three pivots appear in the centre of the breadth of the Beam : *a* is the centre of on which the beam turns in the arch of a circle : *b* is the point where the article to be suspended, and *c* is the point where the poize is suspended, both being *above* the centre of While the beam remains level, the horizontal distances of these points of suspension entre of motion, are *a d*, and *a e*. Depress the larger end of the beam until the point *b* nd the point *c* will rise to *g*. It is evident, that on the falling side the horizontal distance eased to *a f*, and on the rising side, the horizontal distance *a e* is reduced to *a h*.

an encreasing power on the falling side, the reducing power on the rising side is overcome, uilibrium is destroyed. Hence the reason why the Common Steelyard, and every beam d on those principles, must ever be liable to error and to fraud.

e radical error above exemplified, two other errors are united in the Common Steelyard ; h are carefully avoided in the construction of the following instrument.

The
ortional
lance.



### e principles of the Proportional Balance explained.

s of two pivots appear near the shoulder in the beam. *a* is the centre of motion, upon beam turns in the arch of a circle : *b* is the point where the article to be weighed is sus- d *c* is the point where the poize is suspended, both being *on a line* with the centre of While the beam remains level, the horizontal distances of these points of suspension from of motion, are *a b* and *a c*. Depress the larger end of the Beam, until the point *b* falls to *d*, nt *c* will rise to *e*. It is evident that the horizontal distances are both reduced, and that on of distances is always equal or proportional, on both sides of the centre of motion. eam preserves its vibrations like a Scale Beam, and hence the reason why NO ART in nt, can render it a fradulent instrument.

## Demonstration and Experiment in reply to question 3d.

The power of expansion or contraction influences a bar of metal in all its parts equally, provided the whole be of one kind, and be equally subjected to the effects of heat or cold. If the given distance between the pivots of a beam be one, and the length of its shaft be twenty, then the former will expand or contract in the proportion of one, to twenty of the other, whereby the comparative distances and the equilibrium are preserved. Wherefore if a beam could by the Winter's frost, be reduced to one half of its length in Summer, the proportion of the parts and the power of the weights suspended thereon, must remain unchangeably the same.

But as some minds receive fuller conviction from experiment than from mathematical demonstration, they may be less satisfied with the foregoing than the following.

On the evening of January 21st, 1804, I took a small balance in my room, and suspended sixteen pounds on the hook, which I balanced by the Poize at the proper notch ; the thermometer, which was suspended just by it, standing at 38 degrees, or 6 degrees above the freezing point. I then removed both into the open air, where they were suspended together for the term of one hour, when the thermometer fell to 10 degrees, or 22 below the freezing point. The weights were again put on the beam as at first, and an exact equipoize was produced as in the former experiment.

I next placed the beam in a vessel of water, which was made to boil, whereby its temperature was carried to 212, it was then taken out, and the weights were again put on, with as much expedition as possible, when the result, as before, was an exact equipoize.

Thus the instrument was cooled, to sixty six degrees below summer heat, and heated to one hundred and thirty six degrees above it, without producing any variation, and any person who chooses can satisfy himself by similar experiments.

After a strict scrutiny by a Committee of the Honorable GENERAL COURT, an act was passed, authorizing the use of this instrument, in all cases of weighing, throughout this Commonwealth. This act secures to the purchaser the Stamp of a Sworn Sealer on every Beam and its weights.

Since the above period, Certificates of the accuracy and conveniency of this instrument have been so multiplied, that there is not room for their insertion in this advertisement.

In every complaint of a difference in the weight of an article which has been weighed by this balance and by scales and weights, it has been the Subscriber's invariable rule to search for the cause of the difference, when he could come at the scales and weights with which the comparison was made : and in every instance of the kind, which has yet come to his knowledge, the complaint has been found to originate in an error of the Scale Beam, or the iron weights, or in both.

In one instance, five iron weights required no less than ten pounds and half an ounce of lead to adjust them with the Standard ; after which, the weight given by the proportional balance, and that given by the scales were exactly correspondent, which before disagreed essentially.

The Subscriber therefore respectfully solicits, that whenever a complaint of the kind arises, it may be traced to its true source, and that its credit may be carried to the account where it belongs.

## Description of the use of the Proportional Balance.

The weights for the different sizes of this Balance, consist of the following variety—namely, 1 lb. 2 lb. 4 lb. 8 lb. 16 lb. and 32 lb.—every Beam is calculated for two of the above mentioned weights ; one of which is always twice, or four times, or eight times, as heavy as the other.

One of the flat sides of the beam is numbered for the larger, and the other for the smaller of those two weights. Near where the numbers begin, a stamp is impressed on each side of the beam, designating what weight belongs to each side of it.

For example, weights of 16 and 32 pounds are applied to the larger beams, which on one side are stamped P. 16. and on the other P. 32. When those two are not sufficient for weighing the quantity which a beam is designed to draw, more of the larger weights are added ; the number of them being shown by the stamp 2 P. 32, or 3 P. 32, &c. Any article not exceeding the numbers on the *small* side of the beam, may be weighed by either of the weights separately. Any article not exceeding the numbers on the *large* side of the beam, may be weighed by the large weight separately ; or either of those articles (if not too light) may be weighed by both of the weights together. If both are on, the numbers on both sides, where the weights hang, must be added. If any greater number of weights be used, the numbers where they all hang must be added, and their sum is the weight of the article. It is to be observed, that all numbers for the large weights, are to be taken from the large side of the beam ; and for the small weight, from the small side. By these remarks it may be noticed, that in weighing an article of two thousand pounds, *Two Thousand Changes* may be made by different arrangements of the weights, to prove the accuracy of the instrument, or to detect its errors if inaccurate.

Those who wish to weigh ounces with beams of the smaller sizes, may be accommodated with small weights for the purpose, on application at the Factory.

The trouble of lifting the larger weights is reduced by means of a chain, sufficiently long to let the weight rest on the ground, while the hook hangs on the beam. The other weights may be hung upon the lower links of the chain.

By late improvements in the apparatus, the largest hogsheads are now taken up and weighed (without being rolled from their stations) by the labor of two men only, with extreme ease and facility.

To those Gentlemen who have received consignments of Balances, and have promoted the sales by their attention, and the exertions of the Subscriber by their punctuality, he sincerely tenders his thanks, and solicits a continuance of their orders, which will ever claim his prompt attention.

BENJAMIN DEARBORN.

BOSTON, JUNE, 1804.

## List of WEIGHTS

mpany Beams of different sizes, with each Weight annexed.

N, or ENGLISH *Weights.*

| | $ | cts. | FRENCH *or* DUTCH *Weights.* $ | cts. |
|---|---|---|---|---|
| ight of 4 Ounces | | 40 | | |
| 8 Ounces | | 60 | | |
| d do. 1 lb. | | 75 | | |
| 2 lb. | 1 | — | 1 | 10 |
| 4 lb. | 1 | 25 | 1 | 40 |
| 8 lb. | 1 | 75 | 2 | — |
| 16 lb. | 3 | — | 3 | 25 |
| Chain, 16 lb. | 3 | 75 | 4 | — |
| 32 lb. | 5 | 50 | 6 | — |
| Chain, 32 lb. | 6 | 75 | 7 | 25 |
| s wt. for 8 lb. | — | 75 | | |
| do. for 16 lb. | 1 | — | | |
| do. for 32 lb. | 1 | 25 | | |

## List of BEAMS

sizes, and the Weights accompanying their prices annexed.

| | $ | cts. | $ | cts. |
|---|---|---|---|---|
| 100 lb. - - - - - | 3 | — | 6 | — |
| lb. and 8 lb. - - - | 3 | — | | |
| ith a weight of 4 oz. | | | 6 | 40 |
| ith a gross for 8 - | | | 7 | 15 |
| 50 lb. - - - - - | 3 | 50 | | |
| BEAM for 1000 lb. *a* 2 cents - - | 20 | — | 28 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 29 | 75 |
| ditto with grosses for 16 & 32 | | | 32 | — |
| BEAM for 1100 lb. *a* 2 cents - - | 22 | — | 30 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain Weight 32 lb. | | | 31 | 75 |
| ditto with grosses for 16 & 32 | | | 34 | — |
| BEAM for 1200 lb. *a* 2 cents - - | 24 | — | 32 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. - | | | 33 | 75 |
| ditto with grosses for 16 & 32 - | | | 36 | — |
| BEAM for 1300 lb. *a* 2 cents - | 26 | — | 34 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 35 | 75 |
| ditto with grosses for 16 & 32 | | | 38 | — |
| BEAM for 1400 lb. *a* 2 cents - | 28 | — | 36 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 37 | 75 |
| ditto with grosses for 16 & 32 | | | 40 | — |
| *APPARATUS for the above,* SETS *No.* 15 *to* 22. | | | | |
| BEAM for 1500 lb. *a* 2 cents - - | 30 | — | 44 | — |
| Weights 16 lb. and 2 of 32 lb. | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 45 | 25 |
| ditto with gross for 16 & 2 for 32 | | | 48 | 75 |
| BEAM for 1600 lb. *a* 2 cents - | 32 | — | 46 | — |
| Weights 16 lb. and 2 of 32 lb. | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 47 | 25 |
| ditto with gross for 16 and 2 for 32 | | | 50 | 75 |

## A List of ARTICLES

which constitute the Apparatus for Beams of different sizes, with the price of each article annexed.

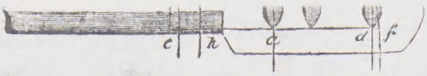
| No. | Article | $ | cts. |
|---|---|---|---|
| | *For small Beams.* | | |
| No. 1. | Tin Scale, - - - - | 1 | 80 |
| 2. | Tin Balance Case, with Shot - | | 20 |
| 3. | A Stand, with Guards - - | 1 | — |
| | *For Beams from* 400 *lb. to* 600 *lb.* | | |
| No. 4. | Folding Scale and Skid, 1st size, - | 6 | — |
| 5. | Scale, Chains, Branch, & Skid 1st size | 7 | 25 |
| 6. | Brass Balance Case with Shot - | 1 | — |
| 7. | Screw and Loop, 1st size, - - | 1 | 50 |
| 8. | Frame and Guard, 1st size, - - | 5 | 50 |
| 9. | Box for Weights - - | | 30 |
| | *For Beams from* 600 *lb. to* 900 *lb.* | | |
| No. 10. | Folding Scale and Skid, 2d size - | 7 | — |
| 11. | Scale, Chains, Branch & Skid, 2d size | 8 | 50 |
| 12 | Brass Balance Case with Shot, - | 1 | 25 |
| 13. | Screw and Loop, 2d size, - - | 2 | 50 |
| 14. | Frame with Guards, 2d size - | 6 | — |
| 15. | Box for Weights - - - - | | 40 |
| | *For Beams from* 900 *lb. to* 1400 *lb.* | | |
| No. 16. | Folding Scale and Skid, 3d size - | 8 | — |
| 17. | Scale, Chains, Branch & Skid, 3d size, | 9 | 75 |
| 18. | Screw and Loop, 3d size - - | 3 | — |
| 19. | Frame with Guards, 3d size - - | 6 | 50 |

## Sets of APPARATUS

adapted to Beams of differant sizes, and so arranged as to suit the convenience of those who may choose a greater or less number of articles in the Set.

| SET | No. | | Articles | $ | cts. |
|---|---|---|---|---|---|
| SET | No. 1. | Articles | 1, and 2. - - | 2 | — |
| SET | .. 2. | do. | 1, 2, and 3 - - | 3 | — |
| SET | .. 3. | do. | 4, 6, and 9 - - | 7 | 30 |
| SET | .. 4. | do. | 4, 6, 7, and 9 - | 8 | 80 |
| SET | .. 5. | do. | 4, 6, 7, 8, and 9 - | 14 | 30 |
| SET | .. 6. | do. | 5, 6, and 9 - - | 8 | 55 |
| SET | .. 7. | do. | 5, 6, 7, and 9, - | 10 | 05 |
| SET | .. 8. | do. | 5, 6, 7, 8, and 9 - | 15 | 55 |
| SET | .. 9. | do. | 10, 12, and 15 - | 8 | 65 |
| SET | .. 10. | do. | 10, 12, 13, and 15 - | 11 | 15 |
| SET | .. 11. | do. | 10, 12, 13, 14, and 15 | 17 | 15 |
| SET | .. 12. | do. | 11, 12, and 15 - | 10 | 15 |
| SET | .. 13. | do. | 11, 12, 13, and 15 - | 12 | 65 |
| SET | .. 14. | do. | 11, 12, 13, 14, and 15 | 18 | 65 |
| SET | .. 15. | do. | 12, 15, and 16 - | 9 | 65 |
| SET | .. 16. | do. | 12, 15, 16, and 18 - | 12 | 65 |
| SET | .. 17. | do. | 12, 15, 16, 18, and 19 | 19 | 15 |
| SET | .. 18. | do. | 12, 15, 16, 18, 19, and 20 | 26 | 90 |
| SET | .. 19. | do. | 12, 17, and 21 - | 11 | 50 |
| SET | .. 20. | do. | 12, 17, 18, and 21 - | 14 | 50 |
| SET | .. 21. | do. | 12, 17, 18, 19, and 21 | 21 | — |
| SET | .. 22. | do. | 12, 17, 18, 19, 20, and 21 | 28 | [illegible] |

Steelyard.



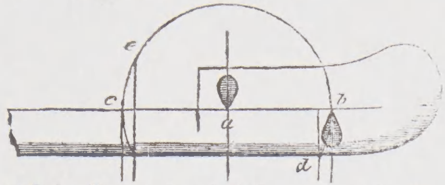
## *The Principles of the Common Steelyard explained.*

The ends of the three pivots appear in the centre of the breadth of the Beam : *a* is the centre of motion, upon which the beam turns in the arch of a circle : *b* is the point where the article to be weighed is suspended, and *c* is the point where the poize is suspended, both being *above* the centre of motion. While the beam remains level, the horizontal distances of these points of suspension from the centre of motion, are *a d*, and *a e*. Depress the larger end of the beam until the point *b* falls to *f*, and the point *c* will rise to *g*. It is evident, that on the falling side the horizontal distance *a d* is increased to *a f*, and on the rising side, the horizontal distance *a e* is reduced to *a h*.

Thus by an encreasing power on the falling side, the reducing power on the rising side is overcome, and the equilibrium is destroyed. Hence the reason why the Common Steelyard, and every beam constructed on those principles, must ever be liable to error and to fraud.

With the radical error above exemplified, two other errors are united in the Common Steelyard ; all of which are carefully avoided in the construction of the following instrument.

The
Proportional
Balance.



## *The principles of the Proportional Balance explained.*

The ends of two pivots appear near the shoulder in the beam, *a* is the centre of motion, upon which the beam turns in the arch of a circle : *b* is the point where the article to be weighed is suspended, and *c* is the point where the poize is suspended, both being *on a line* with the centre of motion. While the beam remains level, the horizontal distances of these points of suspension from the centre of motion, are *a b* and *a c*. Depress the larger end of the Beam, until the point *b* falls to *d*, and the point *c* will rise to *e*. It is evident that the horizontal distances are both reduced, and that this reduction of distances is always equal or proportional, on both sides of the centre of motion. Thus the beam preserves its vibrations like a Scale Beam, and hence the reason why NO ART in management, can render it a fradulent instrument.

cause of the difference, when he could come at the scales and weights with which the c
was made : and in every instance of the kind, which has yet come to his knowledge, the
has been found to originate in an error of the Scale Beam, or the iron weights, or in both.

In one instance, five iron weights required no less than ten pounds and half an ounce of l
just them with the Standard ; after which, the weight given by the proportional balance,
given by the scales were exactly correspondent, which before disagreed essentially.

The Subscriber therefore respectfully solicits, that whenever a complaint of the kind
may be traced to its true source, and that its credit may be carried to the account where it

## Description of the use of the Proportional Balanc

The weights for the different sizes of this Balance, consist of the following variety-
1 lb. 2 lb. 4 lb. 8 lb. 16 lb. and 32 lb.—every Beam is calculated for two of the above
weights ; one of which is always twice, or four times, or eight times, as heavy as the other.

One of the flat sides of the beam is numbered for the larger, and the other for the s
those two weights. Near where the numbers begin, a stamp is impressed on each side of
designating what weight belongs to each side of it.

For example, weights of 16 and 32 pounds are applied to the larger beams, which on on
stamped P. 16. and on the other P. 32. When those two are not sufficient for weighing
ity which a beam is designed to draw, more of the larger weights are added ; the numbe
being shown by the stamp 2 P. 32, or 3 P. 32, &c. Any article not exceeding the numbe
*small* side of the beam, may be weighed by either of the weights separately. Any articl
ceeding the numbers on the *large* side of the beam, may be weighed by the large weight se
or either of those articles (if not too light) may be weighed by both of the weights togethe
are on, the numbers on both sides, where the weights hang, must be added. If any greate
of weights be used, the numbers where they all hang must be added, and their sum is the
the article. It is to be observed, that all numbers for the large weights, are to be taken
large side of the beam ; and for the small weight, from the small side. By these remark
be noticed, that in weighing an article of two thousand pounds, *Two Thousand Changes* may
by different arrangements of the weights, to prove the accuracy of the instrument, or to
errors if inaccurate.

Those who wish to weigh ounces with beams of the smaller sizes, may be accommod
small weights for the purpose, on application at the Factory.

The trouble of lifting the larger weights is reduced by means of a chain, sufficiently long
weight rest on the ground, while the hook hangs on the beam. The other weights may
upon the lower links of the chain.

By late improvements in the apparatus, the largest hogsheads are now taken up and
(without being rolled from their stations) by the labor of two men only, with extreme ease ar

To those Gentlemen who have received consignments of Balances, and have promoted
by their attention, and the exertions of the Subscriber by their punctuality, he sincerely te
thanks, and solicits a continuance of their orders, which will ever claim his prompt attentic

BOSTON, JUNE, 1804. BENJAMIN DEARI

## A List of WEIGHTS

which accompany Beams of different sizes, with the price of each Weight annexed.

| AMERICAN, *or* ENGLISH *Weights.* | | $ | cts. | FRENCH *or* DUTCH *Weights.* $ | cts. |
|---|---|---|---|---|---|
| A Brass Weight of | 4 Ounces | | 40 | | |
| ditto | 8 Ounces | | 60 | | |
| ditto cased do. | 1 lb. | | 75 | | |
| ditto | 2 lb. | 1 | — | 1 | 10 |
| ditto | 4 lb. | 1 | 25 | 1 | 40 |
| ditto | 8 lb. | 1 | 75 | 2 | — |
| ditto | 16 lb. | 3 | — | 3 | 25 |
| ditto with Chain, | 16 lb. | 3 | 75 | 4 | — |
| ditto | 32 lb. | 5 | 50 | 6 | — |
| ditto with Chain, | 32 lb. | 6 | 75 | 7 | 25 |
| ditto Gross wt. | for 8 lb. | — | 75 | | |
| ditto | do. for 16 lb. | 1 | — | | |
| ditto | do. for 32 lb. | 1 | 25 | | |

## A List of BEAMS

of different sizes, and the Weights accompanying them, with their prices annexed.

| | $ | cts. | $ | cts. |
|---|---|---|---|---|
| BEAM for 100 lb. - - - - - - | 3 | — | 6 | — |
| Weights 4 lb. and 8 lb. - - - | 3 | — | | |
| ditto with a weight of 4 oz. | | | 6 | 40 |
| ditto with a gross for 8 - | | | 7 | 15 |
| BEAM for 150 lb. - - - - - - | 3 | 50 | 6 | 50 |
| Weights 4 lb. and 8lb. - - - | 3 | — | | |
| ditto with a weight of 4 oz. | | | 6 | 90 |
| ditto with a gross for 8 - | | | 7 | 65 |
| BEAM for 200 lb. *a* 2 cents - - | 4 | — | 8 | 25 |
| Weights 4 lb. and 16 lb. - - | 4 | 25 | | |
| ditto with a weight of 4 oz. - | | | 8 | 65 |
| ditto with a gross for 16 - - | | | 9 | 65 |
| BEAM for 300 lb. *a* 2 cents - - | 6 | — | 10 | 25 |
| Weights 4 lb. and 16 lb. - - - | 4 | 25 | | |
| ditto with a weight of 4 oz. - | | | 10 | 65 |
| ditto with a gross for 16 - - | | | 11 | 65 |
| *APPARATUS for the above,* SET *No.* 1 *or* 2. | | | | |
| BEAM for 400 lb. *a* 2 cents - - | 8 | — | 12 | 25 |
| Weights 4 lb. and 16 lb. - - - | 4 | 25 | | |
| ditto with weight of 4 oz. - - | | | 12 | 65 |
| ditto with a gross for 16 - - - | | | 13 | 65 |
| BEAM for 500 lb. *a* 2 cents - - | 10 | — | 14 | 75 |
| Weights 8 lb. and 16 lb. - - | 4 | 75 | | |
| ditto with a weight of 8 oz. - - | | | 15 | 35 |
| ditto with grosses for 8 and 16 - | | | 17 | 10 |
| BEAM for 600 lb. at 2 cents - | 12 | — | 16 | 75 |
| Weights 8 lb. and 16 lb. - - | 4 | 75 | | |
| ditto with grosses for 8 and 16 | | | 18 | 50 |
| *APPARATUS for the above,* SETS *No.* 3 *to* 8. | | | | |
| BEAM for 700 lb. *a* 2 cents - - | 14 | — | 18 | 75 |
| Weights 8 lb. and 16 lb. - - | 4 | 75 | | |
| ditto with grosses for 8 & 16 | | | 20 | 50 |
| BEAM for 800 lb. *a* 2 cents - - | 16 | — | 23 | 25 |
| Weights 8 lb. and 32 lb. - - | 7 | 25 | | |
| ditto with Chain-Weight 32 lb. | | | 24 | 50 |
| ditto with 8 lb. and 2 of 16 lb. | | | 23 | 75 |
| ditto do. with Chain-Weight of 16 lb. | | | 24 | 50 |
| ditto do. with grosses for 8 & 16 | | | 26 | 25 |
| BEAM for 900 lb. *a* 2 cents. - - | 18 | — | 25 | 25 |
| Weights 8 lb. and 32 lb. - - | 7 | 25 | | |
| ditto with Chain-Weight 32 lb. - | | | 26 | 50 |
| ditto with grosses for 8 and 32 | | | 28 | 50 |
| *APPARATUS for the above,* SETS *No.* 9 *to* 14 | | | | |
| BEAM for 1000 lb. *a* 2 cents - - | 20 | — | 28 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 29 | 75 |
| ditto with grosses for 16 & 32 | | | 32 | — |
| BEAM for 1100 lb. *a* 2 cents - - | 22 | — | 30 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain Weight 32 lb. | | | 31 | 75 |
| ditto with grosses for 16 & 32 | | | 34 | — |
| BEAM for 1200 lb. *a* 2 cents - - | 24 | — | 32 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. - | | | 33 | 75 |
| ditto with grosses for 16 & 32 - | | | 36 | — |
| BEAM for 1300 lb. *a* 2 cents - | 26 | — | 34 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 35 | 75 |
| ditto with grosses for 16 & 32 | | | 38 | — |
| BEAM for 1400 lb. *a* 2 cents - | 28 | — | 36 | 50 |
| Weights 16 lb. and 32 lb. - - | 8 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 37 | 75 |
| ditto with grosses for 16 & 32 | | | 40 | — |
| *APPARATUS for the above,* SETS *No.* 15 *to* 22. | | | | |
| BEAM for 1500 lb. *a* 2 cents - - | 30 | — | 44 | — |
| Weights 16 lb. and 2 of 32 lb. | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 45 | 25 |
| ditto with gross for 16 & 2 for 32 | | | 48 | 75 |
| BEAM for 1600 lb. *a* 2 cents - | 32 | — | 46 | — |
| Weights 16 lb. and 2 of 32 lb. | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 47 | 25 |
| ditto with gross for 16 and 2 for 32 | | | 50 | 75 |
| BEAM for 1700 lb. *a* 2 cents - - | 34 | — | 48 | — |
| Weights 16 lb. and 2 of 32 lb. | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 49 | 25 |
| ditto with gross for 16 and 2 for 32 | | | 52 | 75 |
| BEAM for 1800 lb. *a* 2 cents - | 36 | — | 50 | — |
| Weights 16 lb. and 2 of 32 lb. - | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 51 | 25 |
| ditto with gross for 16 and 2 for 32 | | | 54 | 75 |
| BEAM for 1900 lb. *a* 2 cents - | 38 | — | 52 | — |
| Weights 16 lb. and 2 of 32 lb. - | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 53 | 25 |
| ditto with gross for 16 & 2 for 32 | | | 56 | 75 |
| BEAM for 2000 lb. *a* 2 cents - | 40 | — | 54 | — |
| Weights 16 lb. and 2 of 32 lb. - | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 55 | 25 |
| ditto with gross for 16 & 2 for 32 | | | 58 | 75 |
| *APPARATUS for the above,* SETS *No.* 23 *to* 34. | | | | |
| BEAM for 1 ton, or 2240 lb. *a* 2 cts. | 44 | 80 | 58 | 80 |
| Weights 16 lb. & 2 of 32 lb. - | 14 | — | | |
| ditto with Chain-Weight 32 lb. | | | 60 | 05 |
| ditto with gross for 16 & 2 for 32 | | | 63 | 55 |
| BEAM for 2500 lb. *a* 2 cents | 50 | — | 69 | 50 |
| Weight 16 lb. and 3 of 32 lb. - | 19 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 70 | 75 |
| ditto with gross for 16 & 3 for 32 | | | 75 | 50 |
| BEAM for 3000 lb. *a* 2 cents - - | 60 | — | 79 | 50 |
| Weights 16 lb. and 3 of 32 lb. - | 19 | 50 | | |
| ditto with Chain-Weight 32 lb. | | | 80 | 75 |
| ditto with gross for 16 & 3 for 32 | | | 85 | 50 |
| *APPARATUS for the above,* SETS *No.* 35 *to* 50. | | | | |
| BEAM and Weights for 4500 lbs. to weigh Loaded Carriages, | | | 100 | — |

The price of the Apparatus for the foregoing Beam, will be proportioned according to the number of articles and their dimensions.

BEAMS with weights for weighing 10000 lb. or a greater quantity, will be furnished if applied for.

## A List of ARTICLES

which constitute the Apparatus for Beams of different sizes, with the price of each article annexed.

| No. | Article | $ | cts. |
|---|---|---|---|
| | *For small Beams.* | | |
| No. 1. | Tin Scale, - - - - - | 1 | 80 |
| 2. | Tin Balance Case, with Shot - | | 20 |
| 3. | A Stand, with Guards - - | 1 | — |
| | *For Beams from* 400 *lb. to* 600 *lb.* | | |
| No. 4. | Folding Scale and Skid, 1st size, - | 6 | — |
| 5. | Scale, Chains, Branch, & Skid 1st size | 7 | 25 |
| 6. | Brass Balance Case with Shot - | 1 | — |
| 7. | Screw and Loop, 1st size, - - | 1 | 50 |
| 8. | Frame and Guard, 1st size, - - - | 5 | 50 |
| 9. | Box for Weights - - | | 30 |
| | *For Beams from* 600 *lb. to* 900 *lb.* | | |
| No.10. | Folding Scale and Skid, 2d size - | 7 | — |
| 11. | Scale, Chains, Branch & Skid, 2d size | 8 | 50 |
| 12. | Brass Balance Case with Shot, - | 1 | 25 |
| 13. | Screw and Loop, 2d size, - - | 2 | 50 |
| 14. | Frame with Guards, 2d size - | 6 | — |
| 15. | Box for Weights - - - - - | | 40 |
| | *For Beams from* 900 *lb. to* 1400 *lb.* | | |
| No.16. | Folding Scale and Skid, 3d size - | 8 | — |
| 17. | Scale, Chains, Branch & Skid, 3d size, | 9 | 75 |
| 18. | Screw and Loop, 3d size - - | 3 | — |
| 19. | Frame with Guards, 3d size - - | 6 | 50 |
| 20. | Single Iron Lever with Chain - | 7 | 75 |
| 21. | Box for Weights - - | | 50 |
| | *For Beams from* 1400 *lb. to* 2000 *lb.* | | |
| No.22. | Folding Scale and Skid, 4th size - | 9 | — |
| 23. | Scale, Chains, Branch & Skid, 4th size, | 11 | — |
| 24. | Brass Balance Case with Shot. - | 1 | 75 |
| 25. | Screw and Loop, 4th size - - | 4 | — |
| 26. | Frame with Guards, 4th size - | 7 | — |
| 27. | Box for Weights, Branch and Chains | | 60 |
| | *For Beams from* 2000 *lb. to* 3000 *lb.* | | |
| No.28. | Folding Scale and Skid, 5th size | 10 | — |
| 29. | Scale, Chains, Branch & Skid, 5th size, | 12 | 50 |
| 30. | Brass Balance Case with Shot, - | 1 | 75 |
| 31. | Screw and Loop, 5th size, - | 4 | 25 |
| 32. | Frame with Guards, 5th size - - | 7 | 75 |
| 33. | Double Iron Lever with Chains - | 12 | — |
| 34. | A pair of Grapnels, - - - | 10 | — |
| 35. | A pair of Canhooks with Chains - | 5 | 50 |
| 36. | Balance Case with Shot for Canhooks | | 75 |
| 37. | Box for Weights, Branch, and Chain | | 75 |
| | *For Beams to weigh Loaded Carriages.* | | |
| No.38. | A Scale to hold the Carriage with its load | | |
| 39. | A small Scale with Chains for the weights | | |
| 40. | A Balance Case with Shot - - | | |

*As the above may vary in size, the prices are not carried off.*

N. B. BALANCED PLATFORMS are also furnished for driving Loaded Carriages on, and weighing them accurately, without suspending them from above.

## Sets of APPARAT

adapted to Beams of differant sizes, and s
ed as to suit the convenience of those
choose a greater or less number of artic
Set.

| SET | No. | | Articles |
|---|---|---|---|
| SET | No. 1. | Articles | 1, and 2. - - |
| SET | .. 2. | do. | 1, 2, and 3 - - |
| SET | .. 3. | do. | 4, 6, and 9 - - |
| SET | .. 4. | do. | 4, 6, 7, and 9 - |
| SET | .. 5. | do. | 4, 6, 7, 8, and 9 - |
| SET | .. 6. | do. | 5, 6, and 9 - |
| SET | .. 7. | do. | 5, 6, 7, and 9, - |
| SET | .. 8. | do. | 5, 6, 7, 8, and 9 |
| SET | .. 9. | do. | 10, 12, and 15 - |
| SET | .. 10. | do. | 10, 12, 13, and 15 - |
| SET | .. 11. | do. | 10, 12, 13, 14, and 15 |
| SET | .. 12. | do. | 11, 12, and 15 - |
| SET | .. 13. | do. | 11, 12, 13, and 15 - |
| SET | .. 14. | do. | 11, 12, 13, 14, and 15 |
| SET | .. 15. | do. | 12, 15, and 16 - |
| SET | .. 16. | do. | 12, 15, 16, and 18 |
| SET | .. 17. | do. | 12, 15, 16, 18, and 19 |
| SET | .. 18. | do. | 12, 15, 16, 18, 19, and |
| SET | .. 19. | do. | 12, 17, and 21 - |
| SET | .. 20. | do. | 12, 17, 18, and 21 - |
| SET | .. 21. | do. | 12, 17, 18, 19, and 21 |
| SET | .. 22. | do. | 12, 17, 18, 19, 20, and |
| SET | .. 23. | do. | 21, 22, and 24 - |
| SET | .. 24. | do. | 21, 22, 24, and 25 - |
| SET | .. 25. | do. | 21, 22, 24, 25, and 26 |
| SET | .. 26. | do. | 20, 21, 22, 24, and 26 |
| SET | .. 27. | do. | 20, 21, 22, 24, 26, 35 & |
| SET | .. 28. | do. | 12, 20, 21, 22, 24, 26, & |
| SET | .. 29. | do. | 23, 24, and 27 - |
| SET | .. 30, | do. | 23, 24, 25, and 27 - |
| SET | .. 31. | do. | 23, 24, 25, 26, and 27 |
| SET | .. 32. | do. | 20, 23, 24, 26, and 27 |
| SET | .. 33. | do. | 20,23,24,26,27,35, & |
| SET | .. 34. | do. | 12,20,23,24,26,27, & |
| SET | .. 35. | do. | 21, 28, and 30 - |
| SET | .. 36. | do. | 21, 28, 30, and 31 |
| SET | .. 37. | do. | 21, 28, 30, 31, and 32 |
| SET | .. 38. | do. | 20, 21, 28, 30, and 32 |
| SET | .. 39. | do. | 20,21,28,30,32,35, & |
| SET | .. 40. | do. | 12,20,21,28,30,32, & |
| SET | .. 41. | do. | 21,28,30,32,33,35, & |
| SET | .. 42. | do. | 12,21,28,30,32,33, & |
| SET | .. 43. | do. | 29, 30, and 37 - |
| SET | .. 44. | do. | 29, 30, 31, and 37. |
| SET | .. 45. | do. | 29, 30, 31, 32, and 37 |
| SET | .. 46. | do. | 20, 29, 30, 32, and 37 |
| SET | .. 47. | do. | 20,29,30,32,35,36, & |
| SET | .. 48. | do. | 12,20,29,30,32,34, & |
| SET | .. 49. | do. | 29,30,32,33,35,36, & |
| SET | .. 50. | do. | 12,29,30,32,33,34, & |

The above Sets are selected from the List

*From Ten to Twenty per Cent is added to the foregoing prices, for Charges of Exportation, on all Balances the Expense and Risque of the Patentee.*

## Gold Standard Balances for Banks, and Hydrostatic Bal

for detecting *Counterfeit Coins,* both constructed upon a different application of princi
any thing of the kind heretofore known, are furnished by B. DEARBORN near the West
the Theatre, Boston.

GILBERT & DEAN, *Printers, State-Street.*